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both sides. Explorations carried on in the Mediterranean, the Red Sea, and the Indian Ocean, showed similar uniformity in the level of the sea bottom; and the general conclusions arrived at by Capt. Osborn were, that in the deep sea there is an absence of bare rock, and that there are no rough ridges, canons or abrupt chasms; moreover, that the bed of the deep sea is not affected by currents or streams, even by those of such magnitude as the Gulf Stream; but that it rather resembles the prairies or pampas of the American continent, and is everywhere covered with a sort of ooze or mud, the *dèbris* of the lower forms of organic life.

Colossal Fossil Sea-Weed.—From the microscopic examination of the structure of specimens of the fossil trunks described under the name of *Prototaxites Logani*, and which Principal Dawson affirmed in his Bakerian lecture before the Royal Society, to be the oldest known instance of Coniferous wood, Mr. Carruthers has discovered that they are really the stems of huge Algæ, belonging to at least more than one genus. They are very gigantic when contrasted with the ordinary Algæ of our existing seas, nevertheless some approach to them in size is made in the huge and tree-like Lessonias which Dr. Hooker found in the Antarctic seas, and which have stems about twenty feet high, and with a diameter so great that they have been collected by mariners in these regions for fuel, under the belief that they were drift-wood. They are as thick as a man's thigh.—*The Academy.*

MICROSCOPY.

Improvements in the Lenses of Microscopes.—For some time, people in England have been content to let the improvement of the optical powers of the microscope remain entirely in the hands of the makers, believing, apparently, that Mr. Lister had effected all in his suggestions and improvements that could be desired. Dr. Royston Pigott, an able mathematician, formerly fellow of St. Peter's College, Cambridge, and a Doctor of Medicine of that University, was not, however, inclined to look at the matter in this way, and for many years has been working and experimenting with a view, first, to test the accuracy of our best object-glasses, and, secondly, to suggest means for their improvement. It should be remembered that Oberhauser, Nachet, and especially Hartnack, on the continent, not satisfied with the old system of combinations for object-glasses, and not having the benefit of Lister's researches, have made excellent objectives on a totally different system, and during the last few years the last-named maker has carried his system of "immersion lenses"to such a point of excellence as really to surpass the best glasses on Lister's system, in definition, penetration, working distance, and illumination. Those who do not admit the excellence of these objectives, which are now used by nearly all German histologists, have probably seen older glasses, made at a time when Hartnack had not reached his best. It is worth stating, now that the Parisian opticians are inaccessible, that Gundlach of Berlin has succeeded in making excellent glasses of high power at astonishingly small prices, some of his 1-12ths and 1-16ths, immersion 1-16ths (so called), being admirable in their performance. They are not, however, equal to Hartnack's glasses, which, though costing far less than what similar English glasses cost, yet are more expensive than Gundlach's. It is only fair to all parties concerned to state that the terms 1-8th, 1-12th, 1-16th, etc., as now applied to an object-glass, appear to have no definite meaning, but depend on the caprice of the maker, since the magnifying power of glasses, with the same fraction assigned to them, differs enormously.

To return to Dr. Royston Pigott. He found the usual means of testing an object-glass by trying if it gave some particular appearance with a "test-object," such as the Podura-scale, very unsatisfactory, since we have no certainty to begin with as to what is the true appearance of such an object. He therefore examined minute images of objects of which he knew the true form, such as a watch-face or thermometer-scale, forming these images by aid of mercurial globules and the condenser properly adjusted below the microscope-field. By this means he has found that object-glasses corrected so as to show dark, sharply marked spines (like ! ! !) on the Podura-scale — a favorite test-object with our microscope-makers — give false, blurred, and distorted appearances with his known images, and on making such corrections of the objective as to show the known images in their true form, he finds that the Podura-scale, examined with the corrected objective, is not really marked at all, as supposed, but is beset with a series of bead-markings, which by intersection, when improperly defined, give the curious appearance like notes of exclamation. This important discovery of the falsity of our high powers (1-8th to 1-16th) has led Dr. Royston Pigott to pay more attention to the lower powers, and he finds that though you may not get so much actual amplification, you yet get a truer effect, and greater clearness of detail, by employing very carefully made low powers (1-2d to 1-5th), and increasing the magnifying power at the other end of the microscope, *i. e.*, the eye-piece. We have in this way seen the beaded structure of the scales of the Podura more satisfactorily than with very high objectives, even when corrected so far as they would admit, and we may say the same of some Diatom-valves, *e. g.*, *Pl. formosum.* It would be most important to know how far such a change of combination would be useful in histological work.

The general upshot of Dr. Royston Pigott's investigations appears to be that it is desirable to shift the burden, hitherto cast almost wholly upon the objective, to the other parts of the instrument. We should be content with an objective as high as a fifth, or even less. A very deep eye-piece is to be used; and to correct residuary aberrations of the objective, and at the same time amplify, Dr. Pigott has introduced an important adjustable combination *between the eye-piece and the object-glass.* There seems to be considerable reason for the step proposed by Dr. Royston Pigott. Just as great results were obtained in passing from the single lens or combination to the compound microscope of eye-piece and objective, so by adding distinct integral factors to these two, such as Dr. Pigott's "aplanatic searcher," we may obtain excellences quite impossible by any amount of attention bestowed on the objective alone, or only with difficulty reached by long labour, leading to very high price for high powers.

Dr. Pigott has, during the past year, published some account of his researches in the *Quarterly Journal of Microscopical Science*, and has communicated papers to the Royal Society, one of which is about to appear in the Philosophical Transactions.

Naturally, at first, the makers in London and the Microscopical Society were sorely tried by Dr. Pigott's exposure of the Podura-scale, but we hear, as one good result already obtained, that Messrs. Powell and Lealand have constructed a new 1-8th, both dry and immersion, with great care, which is declared to be the best glass yet made. It has been proposed to form a committee for the purpose of examining carefully as to penetration, definition, and angular aperture, the best glasses of our English makers, the best American glasses, and the best of Hartnack's, Gundlach's and others; the glasses being mounted similarly, with private marks only for recognition, so as to prevent all possibility of prejudice on the part of the committee. Were this done, the result, whichever way it tended, would be eminently satisfactory. Of this the writer is sure, that many persons — even eminent microscopists — have made up their minds about the qualities of foreign objectives, without having seen any, or only very poor examples, and then when a really fair specimen of such a glass is placed before them, they exclaim with astonishment "Why this is the finest glass I have ever seen." We shall be glad to receive suggestions or assistance, in carrying out the proposed comparison of objectives. Dr. Royston Pigott has expressed his willingness to aid in such an undertaking. — E. R. L., *in Nature.*

COMMITTEE FOR TESTING OBJECTIVES. — Dr. G. W. Royston Pigott proposes (Monthly Microscopical Journal, London, March, 1871) the appointment of a committee for the examination and comparison of objectives by different makers. Both dry and immersion lenses should be tested; and, to avoid prejudice, they should all be mounted in a uniform and simple style, marked in cipher, and identified as the work of known makers only after the final report of the committee. They should be tested in reference to the following properties: — Resolution, Penetration, Magnifying power, Spherical and Chromatic aberration, and Angular aperture. Dr. Pigott also judges that "deep" eye-pieces should be employed, and a very limited and unusual illumination, points which might be left to the judgment of the committee, who would probably prefer to use all kinds of eye-pieces and various methods of illumination, not forgetting, of course, the separate testing of the different parts of the same objective, by the methods lately introduced by Dr. Pigott. (The writer has excellent lenses by the best makers, in which not only are the different zones of angular aperture unequally corrected, probably a more or less unavoidable error, but also the correction is distinctly unequal [from imperfect centering?] at equal distances from the axis; a pencil, say, at 40° from the axis, being better corrected than one at the same distance on the other side of the axis.)

As this subject is largely an international one, though not of sufficient importance to call for the meeting of a committee representing the different countries chiefly interested, any movement, if made at all, in reference to it, should be a concerted movement in England, Germany, France, if practicable, and this country, the same lenses being sent for study from one country to the other. Microscopists might thus be informed, not as to which objectives are the "best," but as to which desirable qualities are possessed in an eminent degree by the lenses of the various makers.—R. H. W.

EYESIGHT AND THE MICROSCOPE.—In using the microscope I have found that the best system is that recommended by Dr. Carpenter, who has probably had as much experience in this matter as any person I know of. It is to alternate the use of the eyes, always keeping the unemployed eye open. But I feel confident that it is of no use to keep the unemployed eye open if it be made to stare at a dead-black surface. It is the exclusion of light from one eye, and the consequent unequal action of the visual organs, that is thus produced, that causes the mischief that we dread; and it matters not whether this unequal action be produced by covering the eye with the eyelid, or by excluding the light from it by other means,—the result is the same. In making observations with the microscope, all extraneous light should be excluded from the eyes. Hence the value of a properly arranged shade. Such a shade, however, should consist of more than a mere flat sheet of pasteboard covered with velvet. It should have a perpendicular portion, rising up in front of the face, and cutting off all light except that which comes through the microscope. And now, having provided a shield of this kind, which, by the way, is easily made of pasteboard blackened on the inside with dead-black varnish (made of alcohol, lamp-black, and a very little shellac), if we punch an inch hole at such a point that the unoccupied eye can see it in the same way that the other eye looks through the instrument, we will find that the fatigue experienced by that eye is vastly less than when it is exposed to the dead-black surface. A few trials will set at rest all questions on this head, and the change from light to darkness is easily made by simply slipping a piece of blackened paper or card over the hole.

With few exceptions, we use altogether too much light with the microscope. Where a full flood of light is passed through a transparent object, the finer points are apt to be "drowned" out entirely; and it is only by modifying the amount of light by means of the diaphram, that we are enabled to make out the more delicate details. Hence it will be found that the use of the bull's-eye condenser, for concentrating the light on the mirror, and consequently augmenting the *amount* of light passing through the object, is, in general, totally unnecessary. This arrangement of the illuminating apparatus is totally different in its effects from that of the achromatic condenser, and cannot be substituted for it, as some persons seem to think.

No man can have worked long with the microscope without being led to a very careful consideration of the relative value of the various sources of illumination at his command. Much thought, and considerable experience, have led me to the following conclusions on the subject:—

The first requisite in the light that we use is *whiteness*. Hence, daylight, the light of a white cloud, the artificial white cloud illuminated by daylight, the light from the old-fashioned argand lamp burning sperm oil, the modern student lamp burning kerosene oil, and its various modifications, and the argand gas-burner, are good—their excellence being about in the order here laid down. Common gas-light, candles, and kerosene lamps are inferior just about in the order we have named. White light is not nearly so fatiguing to the eyes as the reddish glare from a half-smothered combustion. Hence in all cases we must seek to have the most perfect combustion and highest possible temperature of flame in our sources of artificial light. It is true that this gives rise to great heat, but this difficulty is easily obviated by the use of a proper screen or shade, and none will be found better than the one previously described. Indeed, when working by artificial light, it will be found that the heat is one of the most efficient causes of injury to the eyes, and the screen that we have mentioned is, perhaps, quite as useful, from the fact that it cuts off heat, as from its excluding unnecessary light.

The second requisite is steadiness. Nothing is more trying to the eyes than a flickering light.

Another requisite is that the instrument should be so steady that the object shall be retained in view and in focus without change. Any tremor is injurious to the eyes, and especially is this the case when that tremor produces a continual change in the relation of the object to the focus. This difficulty is met chiefly in the use of small, single lenses, that are held in the hand, and it may be safely said that a single hour's work, with a lens of this description held in the hand, or mounted on an unsteady stand, will cause more injury to the eyes than weeks of work where a first-class instrument of far higher power is used. It has always seemed to us that watch-makers, engravers, and those who use lenses, do not sufficiently appreciate this fact. They, in general, mount their lenses on wire stands, which tremblingly respond to every footstep that falls upon the floor, and thus cause continual demands upon the eye for re-adjustment of focus. So, too, we have seen students of botany poring over plants by the hour, and using a small hand-lens, which must have been utterly destructive to the eyes. Wherever a microscope — single or compound — is used for more than a few seconds, it ought to be mounted upon a stand so firm that all vibration, and especially all disturbance of the focussing, will be avoided. — *Good Health.*

ANTHROPOLOGY.

PROBABLE IMPORTANT ARCHÆOLOGICAL DISCOVERY. — In these days of archæological humbugs we hardly venture to copy any account of a reported discovery, but feeling confident that Mr. Meehan would not have printed Mr. Douglas's letter unless he knew him to be a reliable observer, we give the following: — Mr. H. DOUGLAS, of Waukegan, Ill., writes to Mr. Meehan (who has published the letter in the February number of the "Gardener's Monthly"), that during a recent dry season he was enabled to dig to the very bottom of his peat bed, or "muck hole," some six or seven feet below the surface. Under the peat he found "what appeared to be the bottom [shore] of a lake, showing clear sand, gravel, and small shells, exactly like the shores of the lakes so common in this country. Imbedded in this gravel we found a boulder, and around it were charred sticks, looking to all appearances like the remains of a camp fire, and near it we found several poles that had evidently been pointed at the thickest end with an instrument not very sharp, proving, at least to my satisfaction, that Indians had camped there, and that the sharpened saplings were their tent poles cut with a stone hatchet. While digging last summer about three rods from the spot named, we